



International Journal of Education in Mathematics, Science and Technology (IJEMST)

www.ijemst.com

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To cite this article:

Salas-Rueda, R. A., Salas-Rueda, E. P., & Salas-Rueda, R. D. (2020). Analysis and design of the web game on descriptive statistics through the ADDIE model, data science and machine learning. *International Journal of Education in Mathematics, Science and Technology (IJEMST)*, 8(3), 245-260.

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Analysis and Design of the Web Game on Descriptive Statistics through the ADDIE Model, Data Science and Machine Learning

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Article Info	Abstract
<p data-bbox="193 562 368 593"><i>Article History</i></p> <p data-bbox="193 618 336 674">Received: 20 June 2019</p> <p data-bbox="193 703 344 759">Accepted: 13 April 2020</p> <hr/> <p data-bbox="193 790 312 822"><i>Keywords</i></p> <p data-bbox="193 848 349 958">Technology ADDIE model Learning Data science</p>	<p data-bbox="539 562 1401 974">This mixed research aims to analysis and design the Web Game On Descriptive Statistics (WGODS) through the ADDIE model, data science and machine learning. The sample consists of 61 students from a university in Mexico. WGods is a technological tool (quiz game) that presents various questions and answers about statistics (quantitative and qualitative data). The results of the linear regression (machine learning) indicate that the content and aesthetics of WGods have a positive influence on the educational process. The ADDIE model allows the organization of WGods considering the needs of the students. Also, data science identifies 4 predictive models on the use of WGods in the field of statistics through the decision tree technique. Finally, teachers can transform the organization and development of school activities through the ADDIE model and technology. In particular, WGods improves the educational process on the quantitative and qualitative data through a pleasant, attractive, simple, easy and useful web interface.</p>

Introduction

Educational institutions need to transform teaching-learning activities through technology in order to meet the demands of society in the 21st century (Jiménez, Vico, & Rebollo, 2017; Palumbo & Verga, 2015; Premlatha, Dharani, & Geetha, 2016). In particular, the use of pedagogical strategies allows the efficient incorporation of digital tools in the school activities (Wong et al., 2015). Innovation in the field of education refers to the process of designing, organizing and implementing activities that improve the learning process (Han, Wang, & Jiang, 2019; Salas & Vázquez, 2017). For example, teachers are using web applications more frequently in the classroom to develop the competences (Asfour, Zain, Salleh, & Grundy, 2019; Martin et al., 2019; Salas & Salas, 2018; Turan & Meral, 2018; Ugur, 2020). Technological advances are causing the emergence of new pedagogical models, educational methods and active strategies at the higher educational level (Alharthi, 2020; Basuhail, 2019; Salas, 2016; Shoufan, Lu, & Huss, 2015). In fact, the use of digital tools and audiovisual content are causing the creation of new educational strategies in universities (Jiménez, Vico, & Rebollo, 2017). For example, web applications improve the development of mathematical skills (Cahyono & Ludwig, 2019).

Several authors used technology in the fields of mathematics (Al, 2019; Abed, 2019) and statistics (Salas et al., 2019) with the purpose of developing competencies in students. Al (2019) used the Matlab software in the educational process on mathematics in order to develop the skills and improve the understanding of the students. On the other hand, Abed (2019) proposes the use of technological tools, multimedia resources, communication media and virtual classes to improve the teaching-learning conditions on mathematics. The construction of virtual educational spaces and use of digital tools are transforming the organization and realization of school activities in the 21st century (Chiu et al., 2019; Deng, Benckendorff, & Gannaway, 2019; Ledger, Ersozlu, & Fischett, 2019). For example, Salas et al. (2019) built a web application to facilitate the educational process on the calculation of the sample mean through the data simulation. This mixed study uses the ADDIE model to improve the educational process on statistics through the construction of WGods. This web game presents various questions and answers about statistics (quantitative and qualitative data).

Therefore, the research questions are:

- What is the impact of WGods (content and aesthetics) in the educational process on statistics?
- What are the perceptions of the students about the use of WGods in the educational field?
- What are the predictive models on the use of WGods in the educational process considering the decision tree technique (data science)?

Digital Games in the Field of Education

Nowadays, technological applications, web games, online platforms and digital tools have a fundamental role in the teaching-learning process because these technological advances improve the assimilation of knowledge and develop of competences (Omiles et al., 2019; Pereira & Wahi, 2017; Serhan, 2019; Wingo, Ivankova, & Moss, 2017). For example, the use of digital games in English courses improves the academic performance of students (Hung et al., 2018). Educational institutions are building new virtual spaces through the incorporation of Information and Communication Technologies (ICT) in school activities (Lee & Hapke, 2017). In particular, universities are increasing the use of digital games during the teaching-learning process (Hung et al., 2018). Teachers have the opportunity to innovate the educational context through digital games (Clark et al., 2016; Stieler & Jones, 2019). Even educational institutions use digital games to improve social interaction, collaboration, motivation and learning (Kordaki & Gousiou, 2017).

Digital tools and web applications are causing the creation of new virtual spaces for learning and teaching (Brilingaite, Bukauskas, & Juskeviciene, 2018). In particular, digital games have been incorporated into various courses of English (Hung et al., 2018), special education (Vasalou et al., 2017) and mathematics (Denham, 2019). In English courses, digital games favor the active role of students during the performance of school activities (Hung et al., 2018). Likewise, digital games facilitate the assimilation of knowledge on English and development of vocabulary skills (Tsai & Tsai, 2018).

The use of Digital Card Games in the educational field favors critical thinking, collaboration between students and social interaction (Kordaki & Gousiou, 2017). Also digital games such as Words Matter have improved learning conditions in students with dyslexia (Vasalou et al., 2017). Kahoot is a quiz game that facilitates critical thinking, allows the development of competences and improves the academic performance of students (Cameron & Bizo, 2019). In fact, Kahoot's questions and answers increase the motivation and competence of students during the learning process (Cameron & Bizo, 2019). Finally, technology allows the construction of new web scenarios for learning and teaching (Borji, Alamolhodaei & Radmehr, 2018; Weng et al., 2019).

Method

This mixed research aims to analysis and design the Web Game On Descriptive Statistics (WGDOS) through the ADDIE model, data science and machine learning. WGDOS is a technological tool (quiz game) that presents various questions and answers about statistics (quantitative and qualitative data).

Participants

The sample is composed of 61 students enrolled in Statistical Instrumentation for Business course during the spring 2018 semester. They studied the careers of Administration (n=9), Marketing (n=16), Commerce (n=19), Information Technology (n=2) and Accounting (n=15).

Procedure

The procedure began with the use of the ADDIE model to organize the construction of WGDOS (see Table 1).

Table 1. ADDIE Model

No.	Stage	Activity	Description
1	Analysis	Needs assessment	New generations of students use digital tools in everyday life. Therefore, teachers have the opportunity to improve the teaching-learning process through the use of technology in school activities
		Definition of problem	The students of the Statistical instrumentation for Business course have presented difficulties to understand and use the topics on quantitative and qualitative data (frequency, relative frequency and percentage frequency)
		Profile of student	Students took the careers of Administration, Marketing, Commerce,

			Information Technology and Accounting during the spring 2018 semester. Also, they enrolled in Statistical Instrumentation for Business course
		Define the objective	Understand the calculation and use of frequency, relative frequency and percentage frequency for data (quantitative and qualitative)
2	Design	Plan instruction	This research proposes the construction of WGODS considering the aspects on the content (educational agent, questions and graphs) and aesthetics (colors, font and organization of the objects in the web interface) in order to create a pleasant, simple, fast and useful web interface
		Identify resources	WGODS aims to improve the teaching-learning process on the frequency, relative frequency and percentage frequency of data (quantitative and qualitative) by linking the theoretical content with the practical context
		Develop the topics	The topics are frequency, relative frequency and percentage frequency of data (quantitative and qualitative)
3	Development	Create the learning environment	PHP (programming language), HTML (language for the construction of websites) and graphic design allow the construction of WGODS
4	Implementation	Subject	WGODS is used in the Statistical Instrumentation for Business course during the spring 2018 semester
5	Evaluation	Evaluation report	Rapidminer tool allows the calculation of machine learning (linear regression) with 60%, 70% and 80% of training to evaluate the research hypotheses on the use of WGODS in the educational field

WGODS shows various questions related to quantitative and qualitative data (frequency, relative frequency and percentage frequency) and presents feedback through graphs and tables (see Figure 1).

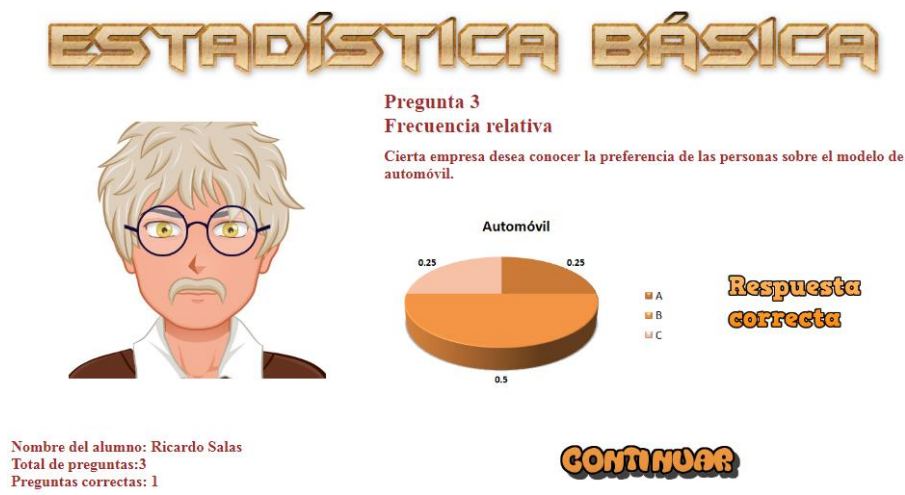


Figure 1. Web Interface of WGODS

Table 2 shows the sequence of activities.

Table 2. Sequence of Activities

Phase	Content	Description
1. Orientation and description of previous ideas	Qualitative and quantitative data	What are the characteristics of the qualitative and quantitative data? What are the examples of qualitative and quantitative data? Why are qualitative and quantitative data important in the productive context?
		Frequency
2. Development and construction of knowledge	Relative frequency	How is the frequency of qualitative and quantitative data calculated? How is the frequency of qualitative and quantitative data plotted?
		Percentage frequency
		How is the percentage frequency of qualitative and quantitative data calculated? How is the percentage frequency of qualitative and quantitative data plotted?
3. Application of knowledge	Productive context	What is the relationship of the qualitative data in the productive context? What is the relationship of the quantitative data in the productive context?
4. Synthesis and evaluation	Utility	What are the benefits on the frequency, relative frequency and percentage frequency of data (qualitative and quantitative) in the real context?

WGODS presents various questions and answers on the frequency, relative frequency and percentage frequency of data (quantitative and qualitative) to improve the teaching-learning process by linking the theoretical content with the practical context (see Table 3).

Table 3. Questions of WGDOS

Question	Theme	Objective	Practical context
1	Qualitative data	Evaluate the calculation on the frequency	Sale of soft drinks
2	Qualitative data	Evaluate the calculation on the frequency	Ice cream flavor
3	Qualitative data	Evaluate the calculation on the relative frequency	Type of automobile
4	Qualitative data	Evaluate the calculation on the relative frequency	Bank
5	Qualitative data	Evaluate the calculation on the frequency	Bachelor's selection
6	Quantitative data	Evaluate the calculation on the frequency	Age of students
7	Quantitative data	Evaluate the calculation on the frequency	Age of employees
8	Quantitative data	Evaluate the calculation on the accumulated frequency	Salary of employees
9	Quantitative data	Evaluate the calculation on the relative frequency	Beverage preference
10	Quantitative data	Evaluate the calculation on the percentage frequency	Purchase products
11	Qualitative data	Evaluate the calculation on the frequency	Quality of food
12	Qualitative data	Evaluate the calculation on the relative frequency	Quality of food
13	Quantitative data	Evaluate the calculation on the frequency	Price of food
14	Quantitative data	Evaluate the calculation on the accumulated frequency	Price of food
15	Quantitative data	Evaluate the calculation on the percentage frequency	Price of food

Figure 2 shows the technology acceptance model used in this research in order to evaluate the impact of WGDOS in the educational process. The content of WGDOS includes the elements of the web interface such as the educational agent, questions and graphs. Also, the aesthetics of the WGDOS refers to the colors, font and organization of the objects in the web interface.

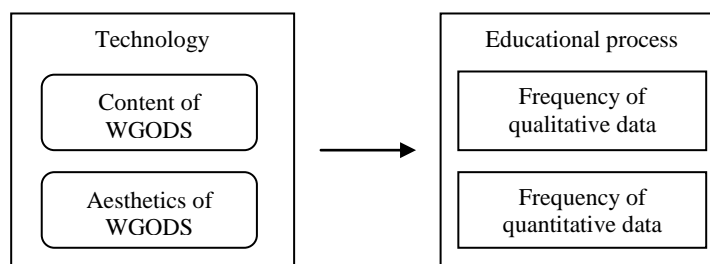


Figure 2. Technology Acceptance Model

This mixed study establishes the following research hypotheses:

- H1: The content of WGODS positively influences the educational process on the frequency of qualitative data
- H2: The aesthetics of WGODS positively influences the educational process on the frequency of qualitative data
- H3: The content of WGODS positively influences the educational process on the frequency of quantitative data
- H4: The aesthetics of WGODS positively influences the educational process on the frequency of quantitative data

Data science allows the identification of the following predictive models by means of the decision tree technique:

- Predictive Model 1: use of WGODS (content) in the educational process on the qualitative data (frequency)
- Predictive Model 2: use of WGODS (aesthetics) in the educational process on the qualitative data (frequency)
- Predictive Model 3: use of WGODS (content) in the educational process on the quantitative data (frequency)
- Predictive Model 4: use of WGODS (aesthetics) in the educational process on the quantitative data (frequency)

Data Analysis

Rapidminer tool are used to perform the analysis of the data. In particular, machine learning (linear regression) allows evaluating the impact of WGODS in the educational process on statistics (see Figure 3)

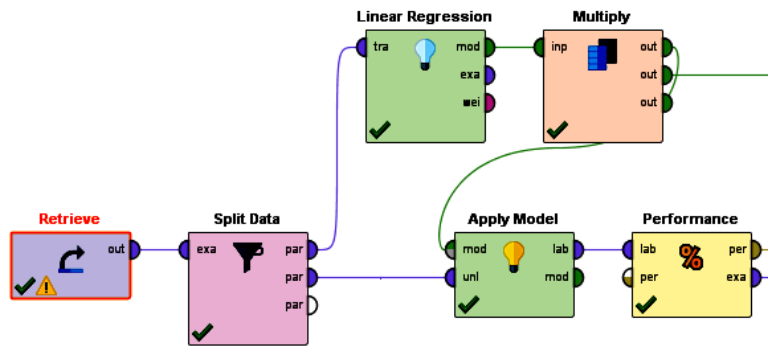


Figure 3. Machine Learning in Rapidminer Tool

Also, Rapidminer tool allows the identification of predictive models on the use of WGODS in the educational process by means of the decision tree technique (see Figure 4).

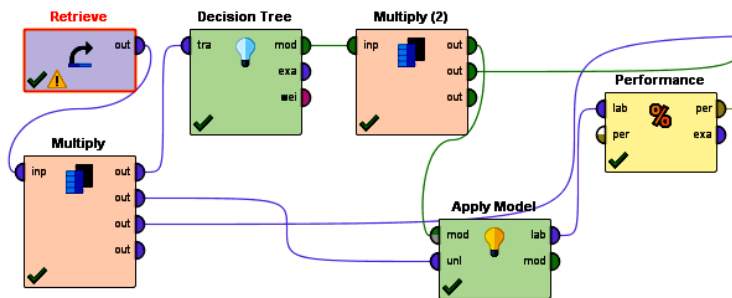


Figure 4. Data Science in Rapidminer Tool

The information of students (sex, age and career), WGODS (content and aesthetics) and frequency of the data (quantitative and qualitative) are used for the construction of predictive models. For example, Figure 5 shows the information used for the construction of Predictive Model 1 about the impact of WGODS (content) during the educational process on the qualitative data (frequency).

Row No.	Qualitative d...	Sex	Age	Career	Content
1	Enough	Woman	19	Com	Enough
2	Totally	Man	20	Mark	Totally
3	Totally	Man	19	Mark	Totally
4	Totally	Woman	18	Mark	Totally

Figure 5. Information for the Construction of the Predictive Model 1

Data Collection

Table 4 shows the measuring instrument (questionnaire) used to collect the quantitative information. The questionnaire has 7 closed questions and 7 open questions related to the use of WGODS in the educational process.

Table 4. Questionnaire (closed questions)

Variable	Dimension	Question	Answer	n	%
Student's profile	Sex	1. Indicate your sex	Man	34	55.74%
			Woman	27	44.26%
	Career	2. Indicate your career	Administration	9	14.75%
			Marketing	16	26.23%
			Commerce	19	31.15%
			Accounting	15	24.59%
			Information Technology	2	3.28%
	Age	3. Indicate your age	18 years old	26	42.62%
			19 years old	24	39.34%
			20 years old	9	14.75%
21 years old			1	1.64%	
22 years old			1	1.64%	
WGODS	Content	4. The content of WGODS facilitates the teaching-learning process	Totally (1)	37	60.66%
			Enough (2)	24	39.34%
			Regular (3)	0	0.00%
			Little (4)	0	0.00%
			Nothing (5)	0	0.00%
	Aesthetics	5. The aesthetics of WGODS facilitates the teaching-learning process	Totally (1)	43	70.49%
			Enough (2)	13	21.31%
			Regular (3)	5	8.20%
			Little (4)	0	0.00%
			Nothing (5)	0	0.00%
Educational process	Frequency of qualitative data	6. WGODS favors the educational process on the frequency of the qualitative data	Totally (1)	38	62.30%
			Enough (2)	23	37.70%
	Regular (3)		0	0.00%	
	Little (4)		0	0.00%	
Frequency of quantitative data	7. WGODS favors the educational process on the frequency of quantitative data	Totally (1)	36	59.02%	
		Enough (2)	24	39.34%	
		Regular (3)	1	1.64%	
		Little (4)	0	0.00%	
			Nothing (5)	0	0.00%

Also, the variable of student perception (Qualitative information) is composed by Teaching-learning process, Motivation, Innovative tool, Support tool, Benefits, Satisfaction and Utility.

Results

The results of this mixed research are related to the design of WGODS, impact of WGODS in the educational process and perceptions of the students.

Design of WGODS

The home page of WGODS requests the data of the student (see Figure 6).

ESTADÍSTICA BÁSICA



Figure 6. Homepage of WGODS

Figure 7 shows Question 1 on qualitative data. In particular, WGODS requests the calculation of the frequency (sale of soft drinks).



Figure 7. Question about Qualitative Data

If the student of the Statistical Instrumentation for Business course answers the question incorrectly then WGODS presents a feedback through the table (see Figure 8).



Figure 8. Feedback of WGODS through the Table

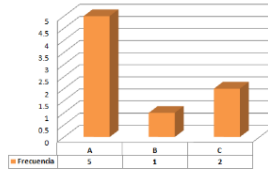
On the other hand, WGODS displays the bar graph for the qualitative data if the student answers correctly the question (see Figure 9).

ESTADÍSTICA BÁSICA



Pregunta 1
Frecuencia

Cierta empresa realiza una encuesta sobre la preferencia de los refrescos.



Respuesta correcta

Nombre del alumno: Ricardo Salas
Total de preguntas: 1
Preguntas correctas: 1

CONTINUAR

Figure 9. Feedback of WGODS through the Graph

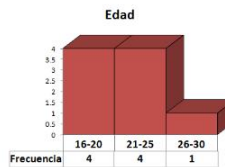
Figure 10 shows the feedback of WGODS for the quantitative data through the histogram.

ESTADÍSTICA BÁSICA



Pregunta 6
Frecuencia datos cuantitativos

En una universidad se realizó una encuesta con el propósito de analizar las variables sobre la carrera y edad de los estudiantes.



Respuesta correcta

Nombre del alumno: Ricardo Salas
Total de preguntas: 6
Preguntas correctas: 2

CONTINUAR

Figure 10. Feedback of WGODS through the Histogram

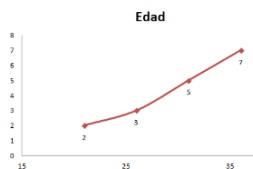
Figure 11 shows the feedback of WGODS for the accumulated quantitative through the given graph.

ESTADÍSTICA BÁSICA



Pregunta 7
Frecuencia

En una organización se analizan las variables sobre la edad y el sueldo de los empleados.



Respuesta correcta

Nombre del alumno: Ricardo Salas
Total de preguntas: 7
Preguntas correctas: 3

CONTINUAR

Figure 11. Graph in WGODS for Accumulated Quantitative Data

Finally, WGODS shows the evaluation on the quantitative and qualitative data (see Figure 12).

ESTADÍSTICA BÁSICA

Tu calificación es : **46.67**

Nombre del alumno: Ricardo Salas
 Total de preguntas: 15
 Preguntas correctas: 7

CONTINUAR

Figure 12. Evaluation in WGDOS

Impact of WGDOS

The results of machine learning with 60%, 70% and 80% of training indicate that hypotheses on the use of WGDOS are accepted. Therefore, the aesthetics and content of WGDOS positively influences the educational process on the frequency of qualitative and quantitative data (see Table 5).

Table 5. Results of Machine Learning

Hypothesis	Training	Evaluation	Linear regression	Conclusion	Squared error
H1: Content of WGDOS → frequency of qualitative data	60%	40%	$y = 0.439x + 0.787$	Accepted: 0.439	0.124
	70%	30%	$y = 0.482x + 0.757$	Accepted: 0.482	0.114
	80%	20%	$y = 0.528x + 0.664$	Accepted: 0.528	0.131
H2: Aesthetics of WGDOS → frequency of qualitative data	60%	40%	$y = 0.217x + 1.154$	Accepted: 0.217	0.177
	70%	30%	$y = 0.254x + 1.127$	Accepted: 0.254	0.170
	80%	20%	$y = 0.299x + 1.033$	Accepted: 0.299	0.169
H3: Content of WGDOS → frequency of quantitative data	60%	40%	$y = 0.496x + 0.720$	Accepted: 0.496	0.232
	70%	30%	$y = 0.533x + 0.696$	Accepted: 0.533	0.254
	80%	20%	$y = 0.577x + 0.610$	Accepted: 0.577	0.360
H4: Aesthetics of WGDOS → frequency of quantitative data	60%	40%	$y = 0.354x + 0.988$	Accepted: 0.354	0.198
	70%	30%	$y = 0.380x + 0.971$	Accepted: 0.380	0.208
	80%	20%	$y = 0.419x + 0.886$	Accepted: 0.419	0.244

The results of machine learning with 60% (0.439), 70% (0.482) and 80% (0.528) of training indicate that hypothesis 1 is accepted. Therefore, the content of WGDOS positively influences the educational process on the frequency of qualitative data (see Table 5). Figure 13 shows the Predictive Model 1 on the use of WGDOS with the accuracy of 81.97%. For example, if the student thinks that the content of WGDOS totally facilitates the teaching-learning process and studies the career of Administration (Adm) then this web game totally favors the educational process on the frequency of the qualitative data.

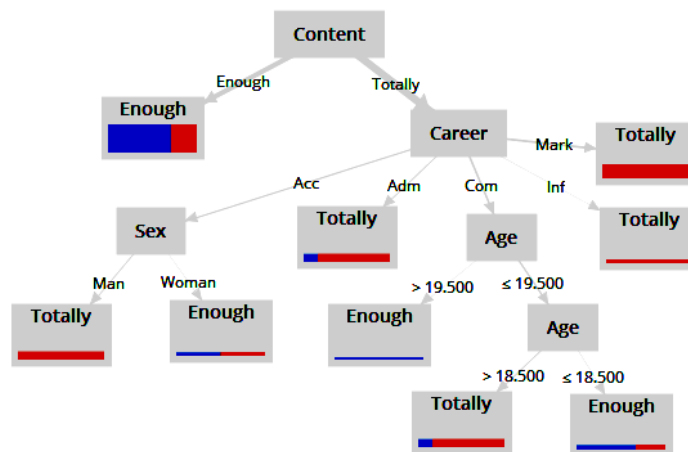


Figure 13. Predictive Model 1 on the Use of WGDOS

The predictive model 1 has 9 conditions on the use of WGODS (see Table 6).

Table 6. Conditions of Predictive Model 1

No.	Content of WGODS → teaching-learning process	Career	Sex	Age	WGODS →frequency of the qualitative data
1	Enough	-	-	-	Enough
2	Totally	Accounting	Man	-	Totally
3	Totally	Accounting	Woman	-	Enough
4	Totally	Administration	-	-	Totally
5	Totally	Commerce	-	> 19.5 years	Enough
6	Totally	Commerce	-	≤ 18.5 years	Enough
7	Totally	Commerce	-	≤ 19.5 years & >18.5 years	Totally
8	Totally	Information Technology	-	-	Totally
9	Totally	Marketing	-	-	Totally

The results of machine learning with 60% (0.217), 70% (0.254) and 80% (0.299) of training indicate that hypothesis 2 is accepted. Therefore, the aesthetics of WGODS positively influences the educational process on the frequency of qualitative data (see Table 5). Figure 14 shows the Predictive Model 2 on the use of WGODS with the accuracy of 77.05%. For example, if the student thinks that the aesthetics of WGODS totally facilitates the teaching-learning process then this web game totally favors the educational process on the frequency of qualitative data.

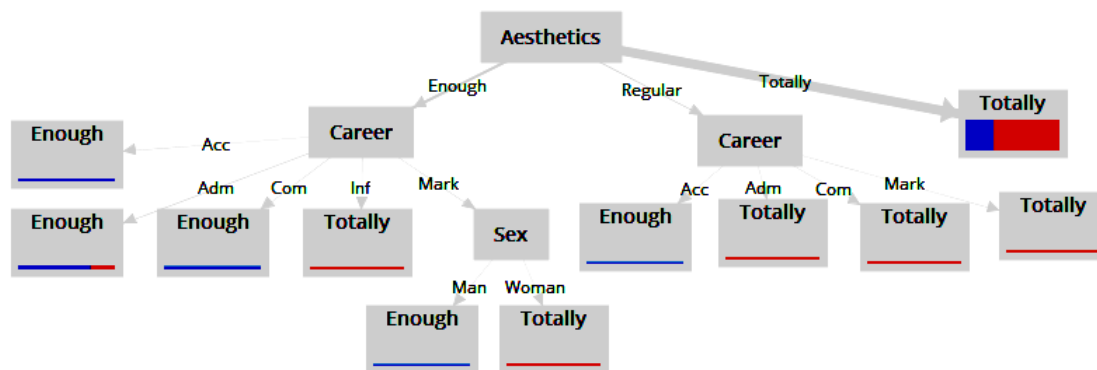


Figure 14. Predictive Model 2 on the Use of WGODS

The predictive model 2 has 11 conditions on the use of WGODS (see Table 7).

Table 7. Conditions of Predictive Model 2

No.	Aesthetics of WGODS → teaching-learning process	Career	Sex	Age	WGODS →frequency of the qualitative data
1	Enough	Accounting	-	-	Enough
2	Enough	Administration	-	-	Enough
3	Enough	Commerce	-	-	Enough
4	Enough	Information Technology	-	-	Totally
5	Enough	Marketing	Man	-	Enough
6	Enough	Marketing	Woman	-	Totally
7	Regular	Accounting	-	-	Enough
8	Regular	Administration	-	-	Totally
9	Regular	Commerce	-	-	Totally
10	Regular	Marketing	-	-	Totally
11	Totally	-	-	-	Totally

The results of machine learning with 60% (0.496), 70% (0.533) and 80% (0.577) of training indicate that hypothesis 3 is accepted. Therefore, the content of WGODS positively influences the educational process on the frequency of quantitative data (see Table 5). Figure 15 shows the Predictive Model 3 on the use of WGODS

with the accuracy of 80.33%. For example, if the student thinks that the content of WGODS totally facilitates the teaching-learning process and studies the career of Accounting (Acc) then this web game totally favors the educational process on the frequency of the quantitative data.

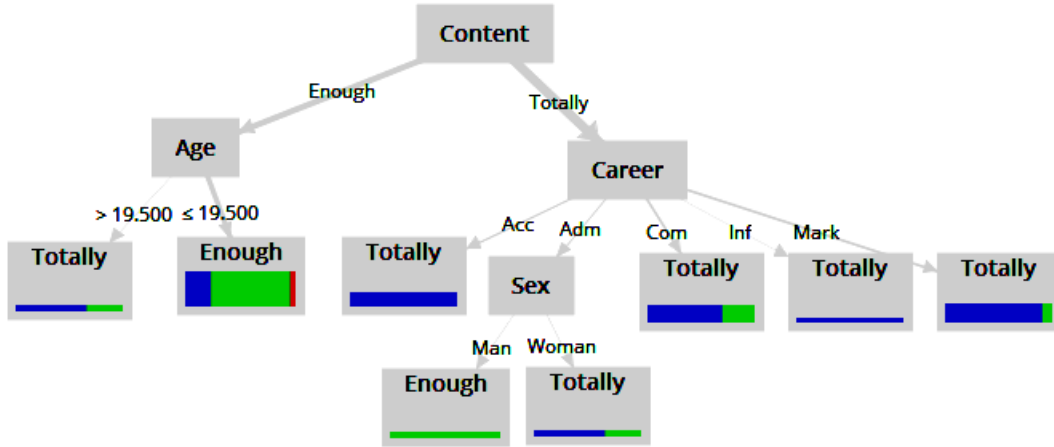


Figure 15. Predictive Model 3 on the Use of WGODS

The predictive model 3 has 8 conditions on the use of WGODS (see Table 8).

Table 8. Conditions of Predictive Model 3

No.	Content of WGODS → teaching-learning process	Career	Sex	Age	WGODS → frequency of the quantitative data
1	Enough	-	-	> 19.5 years	Totally
2	Enough	-	-	≤ 19.5 years	Enough
3	Totally	Accounting	-	-	Totally
4	Totally	Administration	Man	-	Enough
5	Totally	Administration	Woman	-	Totally
6	Totally	Commerce	-	-	Totally
7	Totally	Information	-	-	Totally
8	Totally	Marketing	-	-	Totally

The results of machine learning with 60% (0.354), 70% (0.380) and 80% (0.419) of training indicate that hypothesis 4 is accepted. Therefore, the aesthetics of WGODS positively influences the educational process on the frequency of quantitative data (see Table 5). Figure 16 shows the Predictive Model 4 on the use of WGODS with the accuracy of 80.33%. For example, if the student thinks that the aesthetics of WGODS totally facilitates the teaching-learning process, studies the career of Commerce (Com) and is a woman then this web game totally favors the educational process on the frequency of quantitative data.

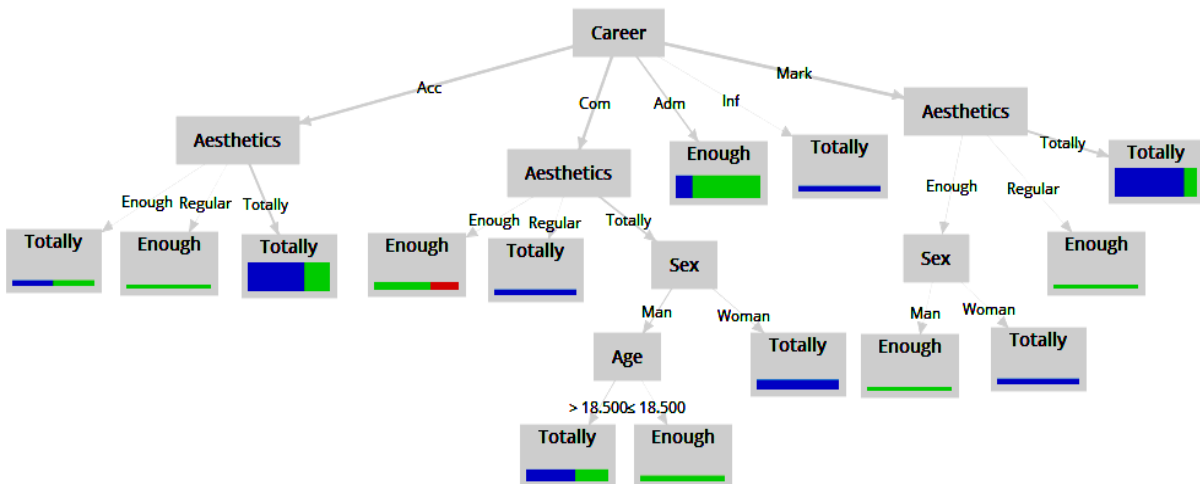


Figure 16. Predictive Model 4 on the Use of WGODS

The predictive model 4 has 14 conditions on the use of WGODS (see Table 9).

Table 9. Conditions of Predictive Model 4

No.	Aesthetics of WGODS → teaching-learning process	Career	Sex	Age	WGODS →frequency of the quantitative data
1	Enough	Accounting	-	-	Totally
2	Regular	Accounting	-	-	Enough
3	Totally	Accounting	-	-	Totally
4	Enough	Commerce	-	-	Enough
5	Regular	Commerce	-	-	Totally
6	Totally	Commerce	Man	>18.5 years	Totally
7	Totally	Commerce	Man	≤ 18.5 years	Enough
8	Totally	Commerce	Woman	-	Totally
9	-	Administration	-	-	Enough
10	-	Information Technology	-	-	Totally
11	Enough	Marketing	Man	-	Enough
12	Enough	Marketing	Woman	-	Totally
13	Regular	Marketing	-	-	Enough
14	Totally	Marketing	-	-	Totally

Perceptions of Students

According to the students, WGODS facilitates the teaching-learning process on descriptive statistics:

Yes, because learning is much easier (Student 1, Woman, 18 years old, Accounting).

Yes, it helps a lot to understand the concepts (Student 5, Woman, 18 years old, Accounting).

WGODS allows the construction of a dynamic virtual space for the learning (frequency, relative frequency and percentage frequency):

Yes, it makes learning more dynamic (Student 9, Woman, 19 years old, Commerce).

Yes, it teaches in an agile and visual way (Student 29, Man, 22 years old, Commerce).

WGODS is an ideal web tool for the educational process on quantitative and qualitative data:

Yes, learning is more didactic (Student 30, Man, 19 years old, Commerce).

Yes, it is an easy tool to use and is available to all (Student 55, Man, 19 years old, Accounting).

Even the graphs on quantitative and qualitative data facilitate the teaching-learning process:

Yes, because we can see it graphically (Student 43, Woman, 19 years old, Marketing).

Yes, the graphics facilitate understanding (Student 48, Woman, 19 years old, Commerce).

Also, the students of the career of Administration, Commerce, Accounting, Information Technology and Marketing are motivated to use WGODS in the Statistical instrumentation for Business course:

Yes, it is fun and friendly (Student 20, Man, 19 years old, Commerce).

Yes, there is interaction with technology (Student 31, Man, 18 years old, Marketing).

According to the students, WGODS is an innovative tool in the educational process on statistics:

Yes, this type of applications is not very common (Student 5, Woman, 18 years old, Accounting).

Yes, it is easier to understand through the graphics (Student 15, Woman, 18 years old, Commerce).

Likewise, WGODS is a support tool for learning related to frequency, relative frequency and percentage frequency:

Yes, it helps us to practice from home (Student 2, Woman, 18 years old, Commerce).

Yes, we can use it as a study guide (Student 12, Woman, 19 years old, Marketing).

The main benefit of WGODS in the educational context is related to learning:

Facilitates the learning process (Student 10, Woman, 19 years old, Marketing).

Improve learning (Student 14, Man, 20 years old, Accounting).

Another benefit is linked to the interactivity of this web game:

Easy, interactive and dynamic (Student 25, Man, 19 years old, Marketing).
 Easy, fun and interactive (Student 34, Woman, 19 years old, Marketing).

Also, the students of the Statistical Instrumentation for Business course indicate that WGODS is easy to use:
 Easy to use and simple (Student 15, Woman, 18 years old, Commerce).
 Easy to use (Student 21, Woman, 18 years old, Accounting).

The students of the career of Administration, Accounting, Commerce, Information Technology and Marketing are satisfied to use WGODS during the school activities:
 Yes, because it helps me to review and study (Student 7, Woman, 19 years old, Administration).
 Yes, because I can practice (Student 12, Woman, 19 years old, Marketing).

Finally, the students think that WGODS is a useful application for the educational process on statistics:
 Yes, it helps me when I do not understand (Student 22, Woman, 18 years old, Marketing).
 Yes, it facilitates the understanding of the content (Student 26, Woman, 20 years old, Marketing).

Discussion

Digital tools and web applications have a fundamental role in the educational context because they allow the construction of new spaces for learning and teaching (Pasa, 2016; Tsai, 2015). In particular, the results of machine learning (linear regression) indicate that WGODS improves the educational process on statistics. This mixed research confirms the ideas proposed by various authors (e.g., Jiménez, Vico, & Rebollo, 2017; Short, 2014; Shatunova et al., 2018) on the importance of digital tools for the transformation of the educational context. For example, WGODS is a useful and innovative technological tool for the teaching-learning process on quantitative and qualitative data.

The results of machine learning with 60% (0.439), 70% (0.482) and 80% (0.528) of training indicate that the content of WGODS positively influences the educational process on the frequency of qualitative data. Also, data science identifies 9 conditions in the predictive model 1. For example, if the student thinks that the content of WGODS totally facilitates the teaching-learning process and studies the career of Administration then this web game totally favors the educational process on the frequency of the qualitative data.

Likewise, the results of machine learning with 60% (0.217), 70% (0.254) and 80% (0.299) of training indicate that the aesthetics of WGODS positively influences the educational process on the frequency of qualitative data. Also, data science identifies 11 conditions in the predictive model 2. For example, if the student thinks that the aesthetics of WGODS totally facilitates the teaching-learning process then this web game totally favors the educational process on the frequency of qualitative data.

Technology is modifying teaching-learning strategies in the 21st century (Badia, Garcia, & Meneses, 2017; Papachristos et al., 2014). In fact, the students of the career of Administration, Accounting, Commerce, Information Technology and Marketing mention that they are motivated and satisfied to use WGODS in the Statistical Instrumentation for Business course. The results of machine learning with 60% (0.496), 70% (0.533) and 80% (0.577) of training indicate that the content of WGODS positively influences the educational process on the frequency of quantitative data. Also, data science identifies 8 conditions in the predictive model 3. For example, if the student thinks that the content of WGODS totally facilitates the teaching-learning process and studies the career of Accounting then this web game totally favors the educational process on the frequency of the quantitative data.

Likewise, the results of machine learning with 60% (0.354), 70% (0.380) and 80% (0.419) of training indicate that the aesthetics of WGODS positively influences the educational process on the frequency of quantitative data. Also, data science identifies 14 conditions in the predictive model 4. For example, if the student thinks that the aesthetics of WGODS totally facilitates the teaching-learning process, studies the career of Commerce and is a woman then this web game totally favors the educational process on the frequency of quantitative data. Finally, advances in technology are causing a radical transformation in the actions and practices of teachers (Han, Wang, & Jiang, 2019; Uppal, Ali, & Gulliver, 2018; Za, Spagnoletti, & North, 2014). In particular, the content and aesthetics of WGODS facilitate the educational process on the frequency, relative frequency and percentage frequency of the data (quantitative and qualitative).

Conclusion

Educational institutions can transform teaching-learning conditions through the ADDIE model and technology. In particular, WGODS improves the educational process on the quantitative and qualitative data through a pleasant, attractive, simple, easy and useful web interface. WGODS improves the teaching-learning process on statistics through the content (educational agent, questions and graphs) and aesthetics (colors, font and organization of the objects in the web interface). In fact, the content and aesthetics of this web game positively influence the educational process on frequency, relative frequency and percentage frequency.

The limitations of this mixed study are related to feedback of WGODS through graphs and tables. Therefore, future research can analyze the design and construction of web systems considering the use of videos. In addition, the use of different languages would allow the personalization of the contents on statistics.

The new information and communication technologies together with the ADDIE model encourage the organization and creation of innovative, useful and creative spaces for the educational context. For example, WGODS offers a simple, useful and pleasant virtual environment for the teaching-learning process on quantitative and qualitative data. Finally, teachers can transform the organization and development of school activities through the ADDIE model and technology.

Recommendations

This research recommends the incorporation of digital games in the educational process and the use of Rapidminer tool to perform the calculation of machine learning and construction of predictive models (decision tree technique).

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